Biological warfare

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INTRO :

- WAR is the energy we put into harming each other. But How little into saving.

"All war is a symptom of man's failure as a thinking animal."
– John Steinbeck Nobel Laureate

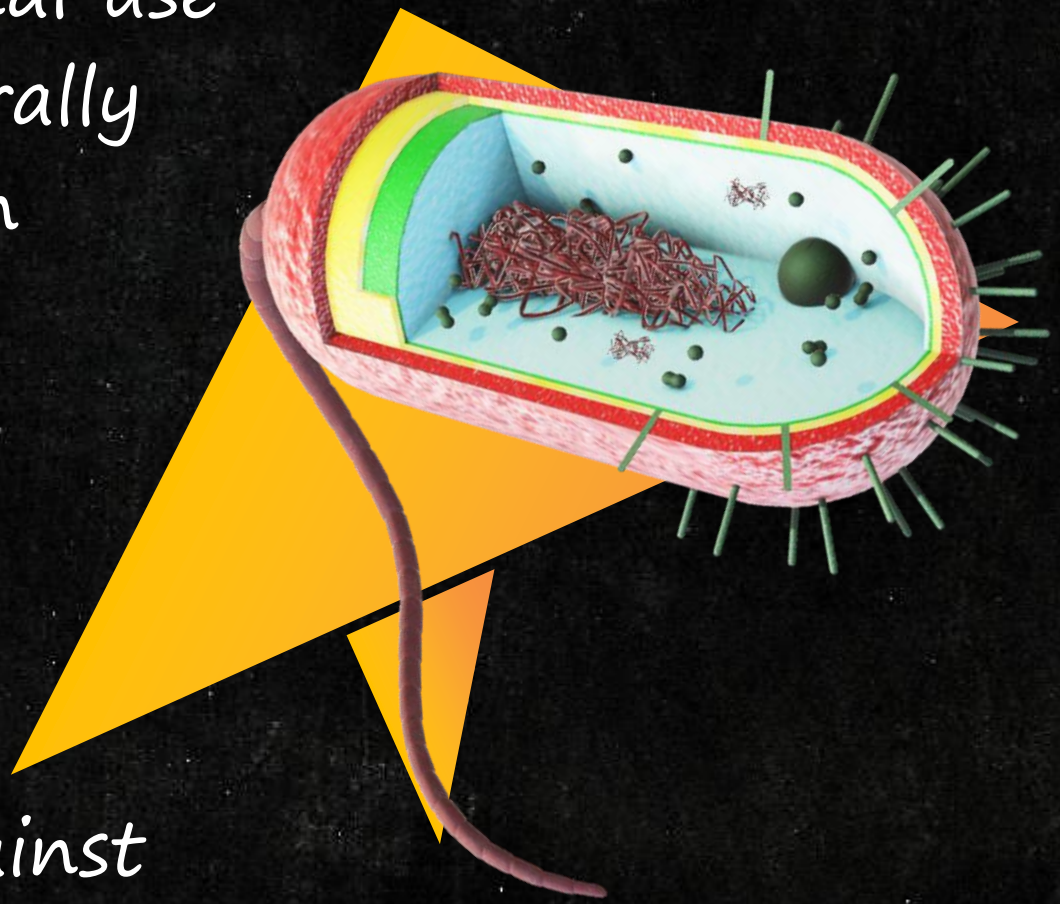
- ETHYMOLOGY :

The word 'war' comes to English from the old High German language word 'Werran' (to confuse or to cause confusion)

FACT : Jebel Sahaba also called site 117 is a prehistoric cemetery site in the Nile Valley The site is often cited as the oldest known evidence of warfare or systemic intergroup violence. Newer apatite dates indicate that the site is at least 11,600 years old.

BIOLOGICAL WARFARE :

- Biological warfare is the intentional use of microorganisms, & toxins, generally of microbial, plant or animal origin to produce disease & death in humans, livestock & crops.



- Use of germs & pathogens in war is one of the dirtiest tricks humans can use against their own kind

Features of biological warfare

weapons

bacterium, virus, protozoan, parasite, toxins & fungus.

Strike

pre meditated and area denial

Goals

Political, religious, ideological, Genocide

Motivation

Fear, disruption, instability,

Why go for biological warfare :-

01 Because microbes are Ubiquitous

As microbes are ubiquitous & some of them are harmful, they are easy to produce or re engineered as bio weapons & they can cause widespread casualties with minimal logistic requirements

02 They are target selective

using genetic engineering we can alter their gene structure in such a way that they can become selective targeting which can be used against inner enemy

04 Quite killers

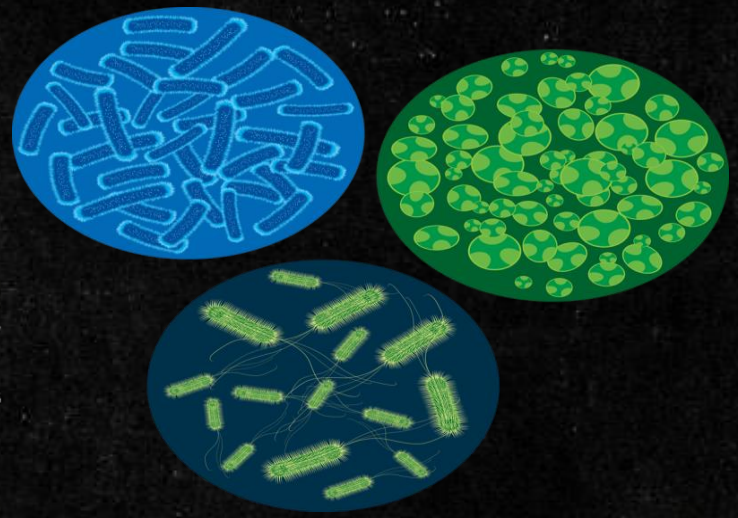
they are difficult to be detected, & differs from conventional weapons, which are deployed primarily for their explosive, kinetic, or incendiary potential

03 More bucks saving

Cost of 50% casualties per meter square is "US$ 1" as compared to conventional weapons (US$ 2000), nuclear armaments (US$ 800), chemical agents (US$ 600)

BIO-WEAPONS

- A Biological agent (AKA bio-agent, biological threat agent, biological warfare agent, biological weapon, or bioweapon) is a Bacterium, Virus, Protozoan, Parasite, Toxin or fungus that can be used purposefully as a weapon in bioterrorism or biological warfare



- The biohazard symbol was developed by the Dow Chemical Company in 1966 for their containment products.

History of Biological warfare :

- It was HERCULES, the greatest hero of Greek mythology, who invented the first biological weapon described in Western literature. When he dipped his arrows in serpent venom of HYDRA

Heracles (Hercules) battling the Lernaean Hydra; at the southern entrance to the Hofburg (Imperial Palace) in Vienna.

FACT : poison & arrows were deeply intertwined in the ancient Greek language itself. The word for poison in ancient Greek, 'TOXICON' derived from Toxon which means 'ARROW'

Examples of biological warfare use during the past 2000 years

1500–1200 BC
victims of tularemia were driven into enemy lands, causing an epidemic.

600 BC
In 1st Sacred War in Greece, Athens poisoned the water supply of town of Kirrha with toxic plant hellebore.

1155 AD
Emperor Barbarossa poisons water wells with human bodies in Tortona, Italy

1346 AD
Tartar forces catapult bodies of plague victims over the city walls of Caffa, Crimean Peninsula

1495 AD
Spanish mix wine with blood of leprosy patients to sell to their French foes in Naples, Italy

1675 AD
German and French forces agree to not use "poisoned bullets"

1763 AD
British distribute blankets from smallpox patients to Native Americans

World War I 1914–1918
German and French agents use glanders and anthrax

World war 2 1939–1945
World War II Japan uses plague, anthrax, and other diseases

Gulf war 1980–1988
Iraq uses mustard gas, sarin, and tabun against Iran

1995
Aum Shinrikyo uses sarin gas in the Tokyo subway system

2001
Anthrax attacks, also known as Amerithrax in USA

Major attacks in Biological Warfare

01

Plague (black death) 1346

02

World war 1

2001 Anthrax attacks

04

World war 2

03

01 In 1346, the bodies of Mongol warriors of the Golden Horde who had died of plague were thrown over the walls of the besieged this lead to death of 25 million peeps

02 Biological sabotage in the form of anthrax and glanders was used by Germany in 1914 causing death of thousands of people

03 In 1940, the Japanese Army Air Force bombed Ningbo with ceramic bombs full of fleas carrying the bubonic plague killing 400,000 peoples in china

04 Letters containing anthrax spores were mailed to several news media offices and to Democratic Senators of USA killing 5 people injuring 17 others

Types of Biological warfare

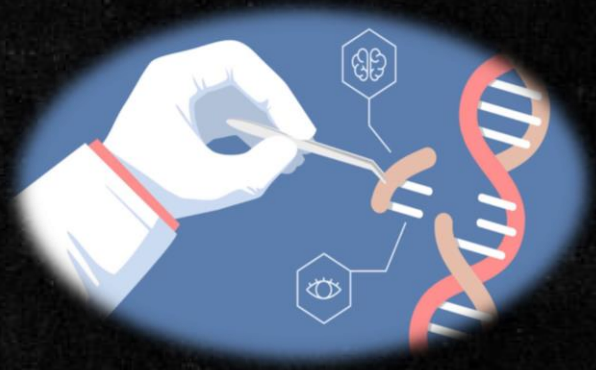
Bio terrorism

It is the deliberate release of viruses, bacteria, or other germs (agents) used to cause illness or death in people, animals, or plants(agrobioterrorism)

Entomological warfare

Entomological warfare (EW) is a type of biological warfare that uses insects to attack the enemy. It uses uninfected insects, such as bees, wasps, etc., to directly attack the enemy.

Gene warfare



novel approaches in biotechnology, such as synthetic biology could be used in the future to design novel types of biological warfare agents

Bio terrorism :

- cost of biological weapon is about 0.05 % the cost of a conventional weapon in order to produce similar numbers of mass casualties per KM^2
- A technique called Clustered, Short Palindromic Repeat (CRISPR-Cas9) is now so cheap and widely available which can be designed by amateurs
- The use of agents that do not cause harm to humans, but disrupt the economy, have also been discussed
- Ex : the foot-and-mouth disease (FMD) virus, which is capable of causing widespread economic damage and public concern (as witnessed in the 2001 and 2007 FMD outbreaks in the UK), while having almost no capacity to infect humans.
- In 2002, when CNN went through Al-Qaeda's (AQ's) experiments with crude poisons, they found out that AQ had begun planning ricin and cyanide attacks with the help of a loose association of terrorist cells

Types of agents used in Bio terrorism

1

CATEGORY A : These high-priority agents pose a risk to national security, can be easily transmitted and disseminated, result in high mortality, have potential major public health impact

EX : Tularemia or "rabbit fever", Anthrax, Small pox, Botulinum toxin, Viral hemorrhagic fever

2

CATEGORY B : These are moderately easy to disseminate and have low mortality rates.

EX : Brucellosis , Epsilon toxin Food safety threats (Salmonella species, E coli, Shigella,) Glanders , Melioidosis Psittacosis ,Q fever.

3

CATEGORY C : these are emerging pathogens that might be engineered for mass dissemination because of their availability, ease of production and dissemination

EX : Nipah virus, Hantavirus

Aspects of protection against bioterrorism

- Detection and resilience strategies in combating bioterrorism EX : BioWatch program
- Implementation of the Generation-3 automated detection system

EX :Anthrax Response Exercise Series

- Enhancing the technological capabilities of first responders is accomplished through numerous strategies

- Tyvex™ armor

- Enhanced equipment for first responders EX : Tyvex™ armor Self-Contained Breathing Apparatuses (SCBA)

- Excelsior Challenge : it is a large emergency response training exercise

- Project BioShield : The accrual of vaccines and treatments for potential biological threats, also known as medical countermeasures has been an important aspect in preparing for a potential bioterrorist attack

Entomological warfare

- It is a type of biological warfare that uses insects to interrupt supply lines by damaging crops, or direct harm to enemy combatants and civilian populations.

- One type of EW involves infecting insects with a pathogen and then dispersing the insects over target areas.The insects then act as a vector, infecting any person or animal they might bite

- Another type of EW is a direct insect attack against crops; the insect may not be infected with any pathogen but instead represents a threat to agriculture

A rat flea, the species used in U.S. EW testing during the 1950s

Entomological warfare by countries

- FRANCE : in WW2 France used beetles against Germany crops
- GERMANY : The Colorado potato beetle was used by Germany in WWII
- JAPAN : Lt. General Shirō Ishii, used plague-infected fleas and flies covered with cholera to infect the population in China.
- USA : in cold war The U.S. dropped over 300,000 uninfected mosquitoes on its own population. To test the biting condition of mosquitos

Colorado potato beetle

Genetic warfare

novel approaches in biotechnology, such as synthetic biology could be used in the future to design novel types of biological warfare agents.

- Would demonstrate how to render a vaccine ineffective
- Would confer resistance to therapeutically useful antibiotics or antiviral agents
- Would enhance the virulence of a pathogen or render a nonpathogen virulent
- Would increase the transmissibility & host range of a pathogen
- Would enable the evasion of diagnostic/detection tools
- Would enable the weaponization of a biological agent or toxin

EX : the role of DNA synthesis and the risk of producing genetic material of lethal viruses (e.g. 1918 Spanish flu, polio) in the lab.

List of biological weapons

Bacterial bio agents

DISEASE	Causative agent (military symbol)
Tularemia	Francisella tularensis (SR or JT)
plague	Yersinia pestis
Melioidosis	Burkholderia pseudomallei (HI)
Listeriosis	Listeria monocytogenes (TQ)
Glanders	Burkholderia mallei (LA)
Diphtheria	Corynebacterium diphtheriae (DK)
Cholera	Vibrio cholerae (HO)
Brucellosis (bovine)	Brucella abortus

Viral bio agents

Disease	Causative agent (military symbol)
Equine Encephalitis (Eastern)	Eastern equine encephalitis virus (ZX)
Equine Encephalitis (Western)	Western equine encephalitis virus (EV)
Japanese B encephalitis	Japanese encephalitis virus (AN)
Marburg Hemorrhagic Fever (Marburg HF)	Marburg Virus (MARV)
Rift Valley fever	Rift Valley fever virus (FA)
Smallpox	Variola virus (ZL)
Yellow fever	Yellow fever virus (OJ or LU)

Biological toxins

TOXIN	Source of toxin (military symbol)
Abrin	Rosary pea (Abrus precatorius)
Botulinum toxins (A through G)	Clostridium botulinum bacteria or spores, and several other Clostridial species. (X or XR)
Ricin	Castor bean (Ricinus communis) (W or WA)
Saxitoxin	Various marine and brackish cyanobacteria, such as Anabaena, Aphanizomenon, Lyngbya, and Cylindrospermopsis (TZ)
Staphyloccocal enterotoxin B	Staphylococcus aureus (UC or PG)
Tetrodotoxin	Various marine bacteria, including Vibrio alginolyticus, Pseudoalteromonas tetraodonis (PP)
Trichothecene mycotoxins	Various species of fungi, including Fusarium, Trichoderma, and Stachybotrys

Rickettsial bio-agents

DIEASE	CAUSATIVE AGENT (MILITARY SYMBOL)
Q Fever	Coxiella burnetii (OU)
Rocky Mountain spotted fever	Rickettsia rickettsii (RI or UY)
Typhus (human))	Rickettsia prowazekii (YE
Typhus (murine)	Rickettsia typhi (AV)

Mycotic bio-agents

Disease	Causative agent
Coccidiomycosis	Coccidioides immitis (OC)

Chlamydial bio-agents

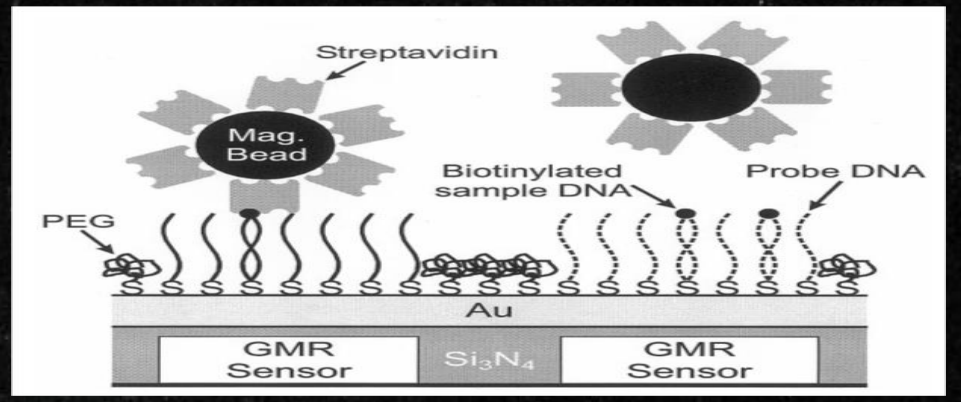
Disease	Causative agent
Psittacosis	Chlamydophila psittaci (SI)

Biological weapons convention

- The Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction (usually referred to as the Biological Weapons Convention, abbreviation: BWC, or Biological and Toxin Weapons Convention, abbreviation: BTWC) was the first multilateral disarmament treaty banning the production of an entire category of weapons.
- Signed - 10 April 1972
- Effective - 26 March 1975
- Condition- Ratification by 22 states
- Signatories- 109
- Parties- 183 as of August 2019

The detection of biological warfare agents

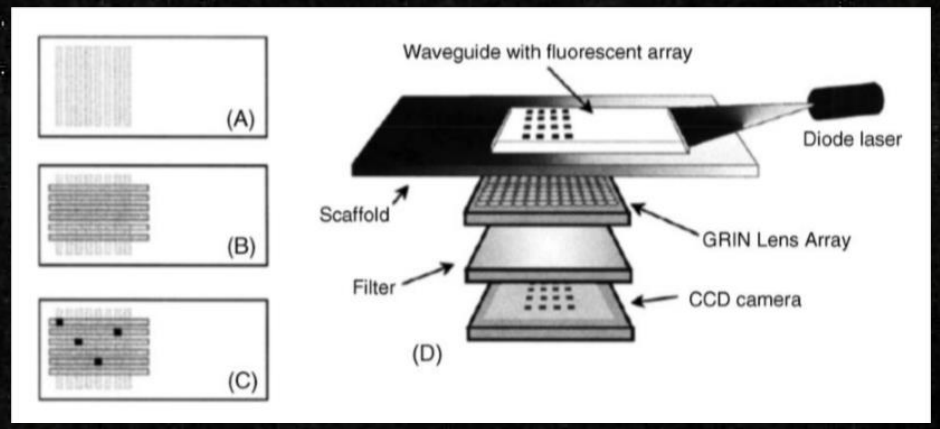
- **The BARC biosensor** – The Bead ARray Counter (BARC) is a multi-analyte biosensor that uses DNA hybridization, magnetic microbeads, and giant magnetoresistive (GMR) sensors to detect and identify biological warfare agents.



schematic diagram of BARC chip

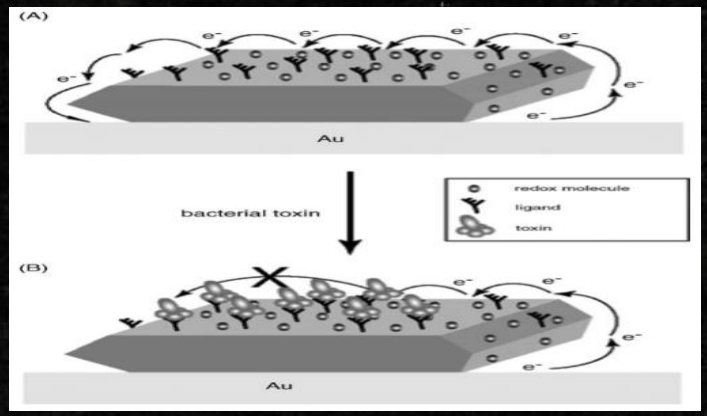
- **Nucleic acid based biosensing tehnology** : they can provide unambiguous identification of characteristic sequence using polymerase chain reaction they helps in detecting virus and bacteria

- **Orthogonal patterning and assay method:**

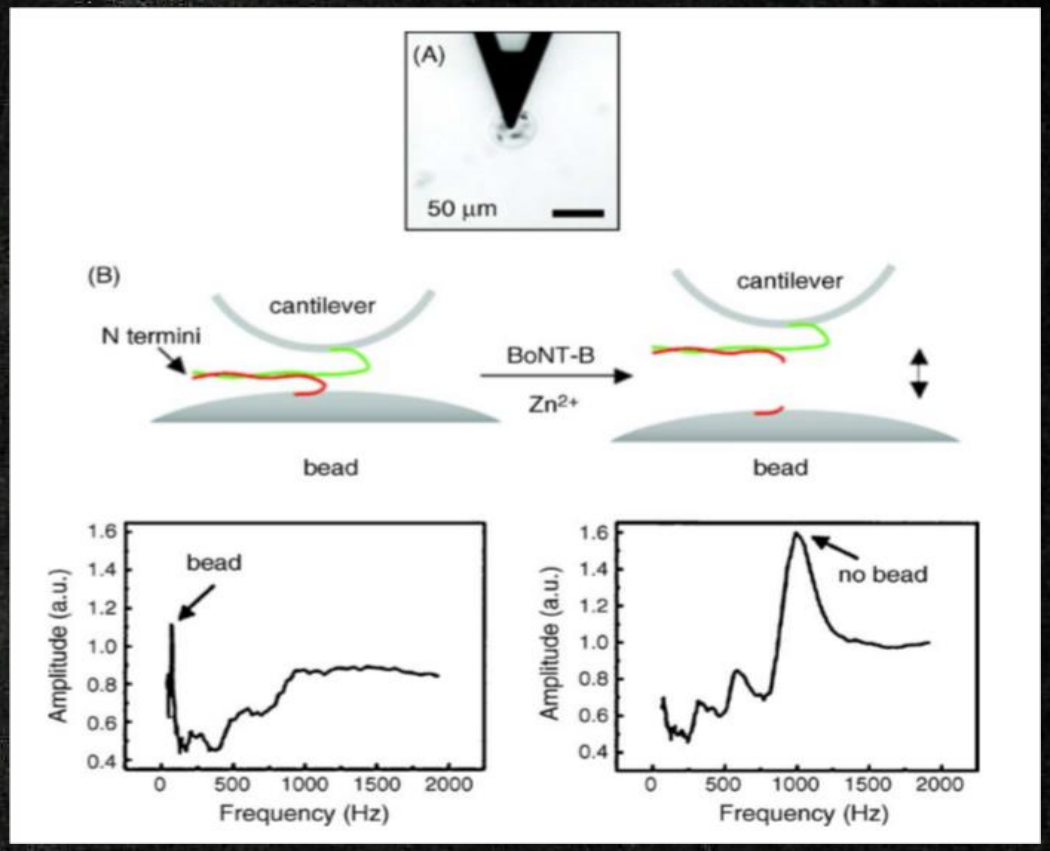


- Redox microstructure sensor : to detect cholera

- A microcantilever based biosensor developed by Parpura and co-workers for the detection of botulinum toxin



(A) Without binding of analyte electrons can hop from one ferrocene to another whilst if cholera binds (B) the hopping pathway is blocked



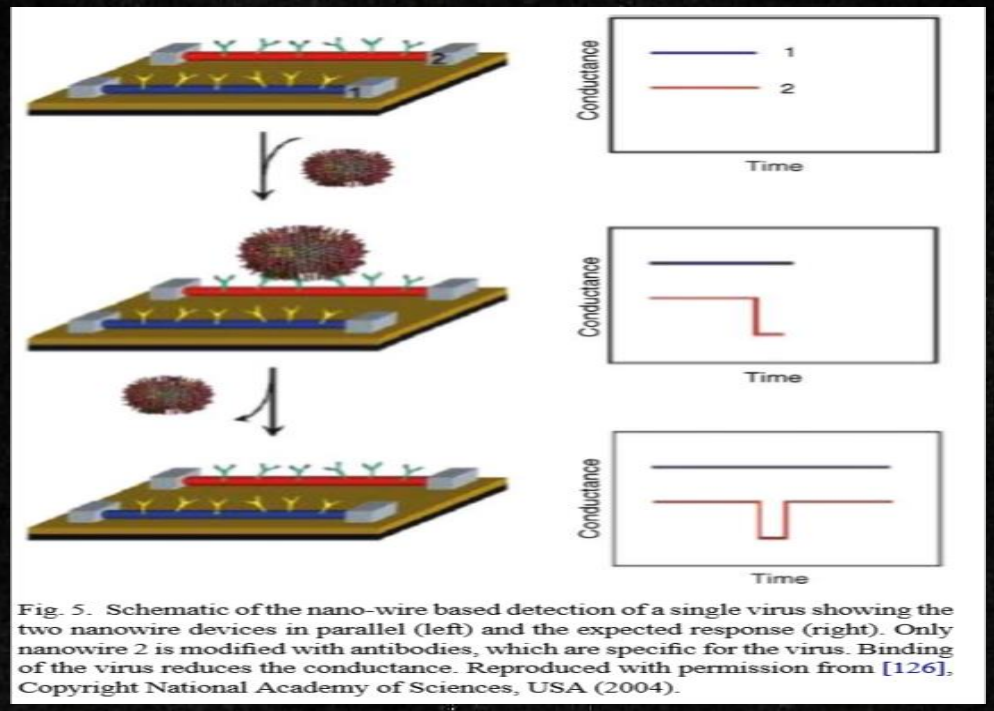


Fig. 5. Schematic of the nano-wire based detection of a single virus showing the two nanowire devices in parallel (left) and the expected response (right). Only nanowire 2 is modified with antibodies, which are specific for the virus. Binding of the virus reduces the conductance. Reproduced with permission from [126], Copyright National Academy of Sciences, USA (2004).

Bio containment :

- Primary containment is the first container in direct contact with biohazardous materialas well as protection of personnel and the immediate laboratory environment from exposure to infectious agents.

- Secondary containment is the protection of the environment external to the laboratory from exposure to infectious materials and is provided by a combination of facility design and operational practices.

Protective suits for bio weapons

- A hazmat suit (hazardous materials suit) is a piece of personal protective equipment that consists of an impermeable whole-body garment worn as protection against hazardous materials
- they are often combined with self-contained breathing apparatus (SCBA) to ensure a supply of breathable air
- Against bio agents through fully sealed systems—often at overpressure to prevent contamination even if the suit is damaged or using powered air purifying respirators with full hoods and protective suits to prevent exposure (level C protection level)

- Personal protective equipment (PPE) is protective clothing, helmets, goggles, or other garments or equipment designed to protect the wearer's body from injury or infection.

Air purifying respirator

N95 mask

PPE gown

INDIAN SCENARIO

- National Disaster Management Authority:

  Coordinating & mandating government policies for disaster reduction/ mitigation

  Devising plans to counter the threat of biological disaster, both natural and man-made (bioterrorism).

  Ensuring preparedness at all levels

  Coordination of response to disaster and post disaster relief & rehabilitation.

  Conducts civilian biodefence and disaster management activities and drills.

Is coronavirus a bioweapon or hoax ?

- To conclude this it is both possible explanation insufficient
- The natural recombination explanation does not work with the pangolin CoV: in the recombination explanation a pangolin would have been infected with two CoV viruses
- the RNA of these viruses would recombine. The problem is that
- there is no such other virus and assuming that there is such a virus only moves the problem further. So it is on DUBIETY that covid 19 a bioweapon or Hoax

Coronavirus crises

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THANK YOU!